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Massachusetts

Manual ... Survey of Lands and Preparing Plans for the Land Court

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The Commonwealth of Massachusetts.

LAND COURT.

MANUAL OF INSTRUCTIONS

FOR THE

SURVEY OF LANDS AND PREPARING
PLANS FOR THE LAND COURT.



BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.

1913.

The Commonwealth of Massachusetts.

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**APPROVED BY
THE STATE BOARD OF PUBLICATION.**

MAR 29 1916

The Commonwealth of Massachusetts.

LAND REGISTRATION OFFICE, BOSTON, July 1, 1913.

This "Manual of Instructions" is issued for the information and guidance of all surveyors and engineers making surveys and plans for the land court.

Compliance with instructions as contained herein is desirable, as no survey or plan can be accepted and approved until these requirements are substantially fulfilled.

This Manual will be known as the Manual of 1913, and supersedes all previous instructions issued from this office, and may be amended from time to time by additional instructions.

CLARENCE C. SMITH,

Recorder.

CLARENCE B. HUMPHREY,

Surveyor for Court.

Approved.

CHARLES THORNTON DAVIS,

Judge.

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PART I.

GENERAL INSTRUCTIONS AND INFORMATION FOR THE PREPARATION OF SURVEYS.

I. LAND REGISTRATION ACT.

1. The Land Registration Act, as contained in chapter 128 of the Revised Laws and all amendments thereto, necessitates an adjudication by the court of the boundaries as well as of the ownership of the premises, and the boundaries so determined remain definite and fixed.

2. While the true lines of ownership are matters to be determined by the court after consideration of the title deeds, the ground plan and such other evidence as may be introduced, the surveyor is requested to indicate the lines of ownership to the best of his knowledge.

II. SURVEYS.

1. The term "survey" in these instructions applies not only to the actual field work, but also to the preparation of the notes, computations and plan.

2. A closed traverse must be made around the property, either upon boundary lines, upon base or transit lines from which the boundaries are located, or upon a combination of both. If upon transit lines, sufficient data from which to calculate all property line dimensions must be shown on the plan or filed therewith.

3. The survey made and reported must, in every case, be an actual survey upon the ground, in full detail, made by or under the supervision of the surveyor whose name appears upon the plan, and must show the actual facts existing at the time.

4. The field work must be so executed as to give complete

information for computing and plotting the survey, without unnecessary computations in this office.

5. The survey must be made not only to secure a plan showing the premises, but in such a manner that the boundaries as determined by the court in the decree can be relocated on the ground from the data shown on the plan or filed therewith.

III. INSTRUMENTS.

1. All surveys must be made with a transit, and one provided with a vertical circle is recommended.

2. A steel tape graduated to feet, tenths and hundredths of a foot must be employed, and should be compared frequently with a standard. For measuring lines in uneven country the use of the vertical circle and tape is recommended, afterward reducing distances to the horizontal.

3. The adjustments of the transit should be carefully looked after, and frequent test made to determine their accuracy.

IV. ADJOINING REGISTERED LAND.

1. On each property surveyed, inquiry should be made to determine whether or not adjoining properties have been registered. If so, the plans filed in the Land Registration Office or at the local registry should be examined, and the surveyor should use the boundary lines previously determined by the court.

2. The number of the plan and the name of the owner of each adjoining registered property should be shown upon the plan.

V. WAYS.

1. The word "way" as hereinafter used will include all streets, avenues, boulevards or roads, whether public or private.

2. Before commencing any survey in the field the lines of these ways, if public, should first be ascertained from the proper officials, and the initial points thus obtained and used should be shown as a part of the survey plan. The data for obtaining these lines are deposited in the offices of the highway commissioners, of the various park commissioners, of the county commissioners, of the city and town engineers, and town clerks.

3. Where stone bounds are shown at the termini and angles of public ways they should be surveyed as they exist upon the ground, and not compiled from the official plans.

4. Where it is difficult to obtain lines of ways in towns or cities, recourse may be had to section 104 of chapter 48 of the Revised Laws, which, as amended by Acts of 1912, chapter 24, reads as follows:—

The county commissioners, mayor and aldermen, selectmen or road commissioners, shall cause permanent bounds to be erected at the termini and angles of all ways laid out by them. Such bounds shall be of stone, or of Portland cement or other concrete, not less than three feet long, two feet of which at least shall be set in the ground, or of stone not less than three feet long with holes drilled therein and filled with lead placed a few inches below the travelled part of the way, or if stone or Portland cement or other concrete bounds are impracticable, a heap of stones, a living tree, a permanent rock, or the corner of an edifice, as said officers may determine. If they neglect to establish such monuments after being notified so to do by an owner of land abutting on such way, the county or city if it is a highway or street or the town if it is a town way, shall forfeit to him fifty dollars for each month during which such neglect continues.

5. Where public ways run through property sought to be registered they should be surveyed, so that distances around each parcel can be shown.

6. In the absence of any fixed lines of private ways it is recommended that stone bounds be placed at angle points or at beginning and end of curves, and that locus be connected with same.

7. When private ways run through property sought to be registered, they should be connected with a public way, if such exists within a reasonable distance, and sufficient monuments located to reproduce them.

VI. RAILROADS.

1. When a property being surveyed adjoins, or is intersected by, a railroad right of way, the base line of location should first be obtained and made a part of the traverse in the survey.

2. From the base line thus surveyed show the sideline location as of record, and locate any physical boundaries pertinent to the purpose.

VII. WATERS AND MEANDER LINES.

1. In the survey of properties bordering on tide waters, ponds, rivers or brooks, the traverse from which the meander lines are located should form a closed traverse with the lines over the upland.
2. A meander line is an irregular or sinuous line which closely follows a shore or stream, and as the court does not determine these lines in the same sense as a line over the upland is determined, but the properties are merely bounded by the ocean, pond or river, these lines need not be defined mathematically, but should be located by offsets or stadia, and shown on the plan as near as scale of same will permit.

VIII. TOWN AND COUNTY BOUNDARIES.

1. Town boundary lines dividing property sought to be registered must be indicated on the plan as accurately as scale of same will permit, and when county lines or lines dividing registry districts are encountered, they must be accurately determined, as each resulting parcel must be registered separately in each registry district. Such properties must be surveyed as separate parcels.
2. The commonwealth has issued boundary atlases of most of the towns and cities. These atlases, besides showing all data in the town lines, also show all of the State triangulation points, and it is recommended that these be made use of when convenient.
3. The corners themselves are located by terrestrial co-ordinates and marked by well-defined monuments. The true lines are between corners, and although mention is made of, and the law requires road stones to be set at, the intersection of highways and town lines, those found may or may not be on the true lines.
4. These stones may be used to connect surveys, and when so used are valuable to relocate the property, but care should be used in assuming them to be on the town lines unless shown to be so by survey.

IX. AZIMUTHS OR BEARINGS.

1. In computing directions of lines azimuths or bearings may be used. When azimuths are used they should be computed clockwise, and zero may be referred to a meridian or to an assumed base, which could be a railroad location line, road line or a line between two intervisable fixed points on the locus.
2. When bearings are used in computations the needle should indicate whether they are true or magnetic, and note made showing which line was used as a basis for the computations.
3. In either method the directions of all other lines are to be computed from the base thus established, using the angle measured at each station.
4. It is not required that the true meridian be ascertained by astronomical observation, but it is recommended that where lines in the vicinity have been determined they be used.

X. TRIANGULATION POINTS.

If there is a state triangulation point or town boundary stone within locus or in close proximity to any corner, connection should be made with same by triangulation or by traverse. These data may be shown either on plan or accompanying sketch, and no calculations need be made.

XI. MONUMENTS.

1. There should be two or more permanent monuments upon or near each locus, and connected with the survey, that could be used at any future time to relocate the boundary lines.
2. Where a street or railroad location is monumented, if the two bounds marking the termini of a tangent or curve are intervisable, they should be used as a base line for the survey. In the absence of bounds the surveyor should set them either at above-named points or at intervisable lot corners, and mark them station 1 and 2, respectively, in tabulating his traverse.
3. Each monument set by a surveyor should be, where the ground will allow, of stone or cement of such a nature as to prevent displacement or erosion for many years. It should be about 6 inches square on top and such a length that when set into the ground the base will be below frost line. It should

have a drill hole or cross cut in its top, and in absence of same the point made by the intersection of its diagonals will be used unless otherwise noted upon the plan. Where points fall upon bowlders or ledge, a drill hole should be made, and if at a point used for both traverse and a property corner, an iron rod should be placed therein.

4. It is the practice in some towns and counties to set road bounds entirely in the road, so that one corner or middle of the back edge is at the point to be used. Care should be taken to ascertain this fact.

5. In setting bounds ordered by the court it is recommended that for marking termini of lines of ways the bounds be set entirely in the way; if for side lines of ways, the middle of back edge to be correct; if at a street corner, one corner of bound to be correct; and if on an offset line, a drill hole in the top to be correct. On property lines and lot corners the bounds should be set so that the center is correct.

6. In making out a certificate certifying that a bound has been set as ordered, make a rough sketch on the same, indicating part of bound which marks the point.

7. When stone bounds are set by order of petitioner after decree has been entered, it is recommended that a record of their location be filed in this office by the surveyor under whose direction the bounds were set.

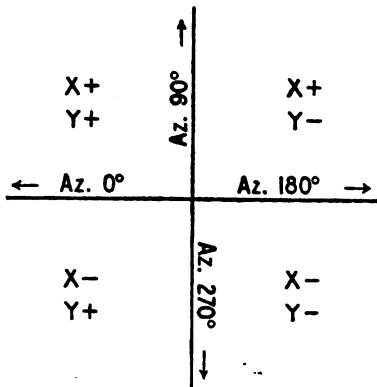
XII. RECTANGULAR CO-ORDINATES.

1. Where a town or city has a survey using a system of rectangular co-ordinates based upon plane surveying, such, for example, as is found in the Brighton and Dorchester districts of Boston, and its streets are thus located, these positions should be shown upon the survey plans in addition to the other data, and in each case at least two of these positions must be marked by permanent bounds.

2. In many instances tracts of registered land have been reduced in this office to a system of rectangular co-ordinates for the purpose of plotting, checking surveys and locating subdivisions and adjoining parcels. In each case there has been used as an origin and base the line which is most nearly parallel and at right angles to all the other lines to facilitate calcu-

lations, and allowance has been made for having blocks bounded by one or more streets referred to this same base. Where these co-ordinate positions occur on plans filed with certificates, they should be used in subdivisions and in surveying adjoining lands in the same block.

3. The systems used are latitudes and departures and x's and y's; but where positions are referred to assumed axis (not meridian lines) it is recommended that the system of azimuths and x's and y's be used. The azimuth of the base line should be 0, and all azimuths read clockwise. The distances known as x's and y's should have algebraic signs in their respective quadrants, as indicated on the following sketch:—



4. When survey plans show co-ordinate positions of points on the boundary line they must also show bearings and distances between them.

PART II.

CLASSIFICATION OF SURVEYS AND INFORMATION FOR PREPARING PLANS AND CALCULATIONS.

XIII. CLASSIFICATION OF SURVEYS.

For the purpose of standardizing surveys that are reported, they will be classified as follows: Class A, B, C, D and E; and the surveyor, knowing the location, valuation, etc., must use his judgment in classifying the same.

Class A. — City surveys will include properties which lie in the city or town proper where the lines are middle of partition walls, face of buildings, etc., and where extreme accuracy is desired.

Class B. — Suburban surveys will include properties which lie in the residential districts, and will include one lot or an estate containing several lots.

Class C. — Country surveys will include properties occupied as country estates, which may or may not be subdivided in the near future.

Class D. — Farm surveys will include properties used for agricultural purposes and which are distant from a town or city center.

Class E. — Timber surveys will include all properties not classified above, such as isolated land and mountain tracts.

XIV. ERROR IN ANGULAR MEASUREMENT.

1. In running traverse lines and establishing traverse stations a semi-permanent point should be used which could be found for future relocation, or to check any portion of the work before the survey is finished. For these points a large spike, wooden plug or drill hole in a ledge or boulder should be used.

2. All angles should be doubled, to eliminate error of first reading, and the number of times of repetition beyond this will depend upon the length of lines and accuracy desired.

3. In classes A and B the total error of closure, expressed in minutes, should not exceed .5 $\sqrt{\text{number of angles}}$; Class C $\sqrt{\text{number of angles}}$ and classes D and E $\sqrt{3}$ $\sqrt{\text{number of angles}}$.

4. The adjustment of angles should be made by the party doing the field work, and his judgment be used as to whether the error should be distributed proportionately, placed between short lines or in difficult readings.

XV. RATIO OF CLOSURE.

1. The ratio of closure as hereinafter mentioned will be expressed in the form of a fraction, with 1 as the numerator. It will be determined by the following formula:—

$$\frac{\text{Error of closure}}{\text{measured length of all lines of closed traverse}} \text{ as } \frac{1}{X}$$

Where error of closure = $\sqrt{(\text{error in lat.})^2 + (\text{error in dep.})^2}$

$$\text{or} = \sqrt{(\text{error in sines})^2 + (\text{error in cosines})^2}$$

2. *Class A.* — The ratio of closure of these surveys should not exceed 1:10000, but when we receive the finished product, errors adjusted, the results should be exact.

3. *Class B.* — The ratio of closure of these surveys should not exceed 1:8000.

4. *Class C.* — 1:5000.

5. *Class D.* — 1:3000.

6. *Class E.* — 1:1500

XVI. COMPUTATIONS.

1. The class of survey, date, location and name of surveyor must be placed at the top of each sheet and filed in this office as a part of the plan.

2. The angles must be computed and corrected, ratio of closure determined and errors in latitudes and departures balanced on forms approved by this office.

3. In surveys where the traverse filed represents property lines themselves, and is the result of office computations, use form 1 or 2. There should be no error in these traverses.

4. In surveys where the traverse is on transit lines, or partly on transit and partly on property lines show measured angles, corrected angles, azimuths or bearings, distances, computed latitudes and departures (or sines and cosines), ratio of closure and balanced results, use calculation form 3 or 4.

5. The adjustment of the traverse, the same as the adjustment of the angles, as mentioned in subject XIV., paragraph 4, should be made by the party doing the field work. If in his judgment the error should be distributed proportionately throughout the traverse, the latitudes and departures, or sines and cosines, shall be balanced in the following manner:—

As the arithmetical sum of all the latitudes (or departures) is to any one latitude (or departure), so is the whole error in latitude (or departure) to the correction to the corresponding latitude (or departure), each correction being so applied as to diminish the whole error in each case.

6. All computations to be computed to the nearest hundredth of a foot.

XVII. MAKING OF PLANS.

1. The plan must be made upon tracing cloth.
2. The sizes to be 18 by 24 inches or 24 by 36 inches, beyond which any convenient size may be used.
3. The title must state the location, scale, date, name and address of surveyor.
4. The plan must show north point, area, town or county lines, names of adjoining owners, passageways, official street lines, fences, walls, buildings, boundary monuments (using proper conventional signs), and any other natural monuments pertinent to the purpose.
5. The scale used must be such as to show clearly all data necessary.
6. The area may be by calculation or by scale, and if by scale affix the sign \pm .
7. In addition to buildings on locus, show such part of all buildings and other physical features on adjoining land that are within 10 feet of boundary line.
8. Show the boundaries of the property, dimensions and all physical features pertinent to the location of it in black, all traverse lines and surveying data in red.

9. The plan must have plainly indicated on it the manner in which each corner, property line and reference point is marked upon the ground. This information is very essential, for the reason that respondents often object to a plan and survey for the reason that a stone bound, partition wall, retaining wall, or other object used to mark a boundary, has been erroneously included or excluded. On this account careful inquiry should be made to determine the ownership of such boundary monuments.

10. The parcel sought to be registered must be enclosed within a blue tint. Where colors are used to distinguish buildings, water, etc., and blue is used for water, enclose parcel with a green tint.

11. The property should be oriented upon the plan in such a manner that the top is in a general northerly direction.

XVIII. MAKING SUBDIVISION PLANS.

1. Revised Laws, chapter 128, section 43, is as follows:—

A registered owner who holds one duplicate certificate for several distinct parcels of land may surrender it, with the approval of the court, and take out several certificates for portions thereof, or if he holds separate duplicate certificates for several distinct parcels, he may surrender them and, with like approval, take out a single duplicate certificate for the whole land, or several certificates for different portions thereof. An owner who subdivides a tract of registered land into lots shall file with the recorder a plan thereof, when applying for a new certificate or certificates, and the court, before issuing the same, shall cause the plan to be verified, and require that all boundaries, streets, and passageways shall be distinctly and accurately delineated thereon.

2. Each decree issued by the court and sent to the registry is accompanied by a decree plan, which is a copy of a part of the plan filed with the petition, and shows the lines as determined and approved by the court. The title number and plan letter appear in the upper right corner, which should be referred to in asking for or making a subdivision plan.

3. The sizes to be 8½ by 11 inches, 18 by 24 inches, 24 by 36 inches, beyond which any convenient size may be used.

4. This plan should show facts as they exist upon the ground at the time of subdivision, using proper conventional signs and showing sufficient data to connect it with the original decree plan.

5. It should in every other respect conform to the instructions issued for making plans to accompany petitions, and should show all data necessary to calculate or reproduce any or all of the lines shown thereon.

XIX. SURVEYOR'S CERTIFICATE.

This certificate must be written or printed on each survey plan accompanying petition, and signed.

I certify that this survey was made in accordance with land court instructions.

Date,.....

.....,
Surveyor.

XX. SKETCH PLAN.

1. All surveys reported are indicated upon atlases in this office by enclosing the property within a blue tint and showing the title number. These atlases may be used by surveyors and the public if they wish to ascertain if certain properties are registered.

2. When surveys reported are not easily located they should be accompanied by a sketch traced from the county or State atlases, showing its location.

XXI. TIE LINES.

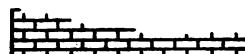
1. In classes A and B the survey should be connected with other surveys of registered land in the immediate vicinity.

2. In classes C, D and E the survey should be connected with other surveys of registered land that lie within 500 feet of any corner. These data may be put on plan or filed as data on back of calculation sheet.

XXII. CONVENTIONAL SIGNS FOR COURT PLANS.

Buildings, either of three methods:—

1. Graphical, brick (along the face),



wood (along the face),



stone (along the face),



brick partition walls (cross hatch),



2. Colors.

3. Descriptive, brick, hatch edge and mark,



wood, hatch edge and mark,



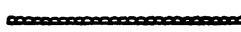
stone, hatch edge and mark,



Stone wall,



Faced wall or retaining wall,



Fence,



Fence, where posts are to be shown,



Town or county boundary line,



Private ownership line,



Private ownership line, where it is not advisable to use a full line.



Stone bound,



Stone bound, where property lines intersect,



Stone bound, marking a P. C. or P. T.,



Stone bound, at intersection of streets,



Triangulation station,



Transit point,



Stake,



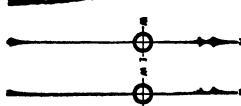
Mean high-water line,



True meridian,



Magnetic meridian,



XXIII. ABBREVIATIONS FOR COURT PLANS.

PART III.

CALCULATION FORMS, TABLES, ETC.

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Sample plan in Class A (Plan A ²),	Folder
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All of these sheets are compiled from plans filed with petitions, and are good examples of Class A surveys. The data shown are in each case results of office calculation, and data such as field notes are shown outside of locus, to enable same to be reproduced.

A full set of specimen plans are being prepared which will show examples in all classes of surveys. Blueprint copies of this set may be had upon application by paying cost of printing.

CALCULATION SHEET, FORM 1.

[Size of all calculation sheets, for filing, to be $8\frac{1}{2}$ by 11 inches.]

LAND COURT.

LAND IN

ЛІЧИМОСТІ

CALCULATION SHEET, FORM 2.
LAND COURT.

**CALCULATION SHEET, FORM 3.
LAND COURT.**

LAND IN

SURVEYED BY

PLAN NO.

**CALCULATION SHEET, FORM 4.
LAND COURT.**

LAND COURT
TABLE OF RODS AND LINKS EXPRESSED IN FEET

LINKS	R O D S																				
	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	10	11	12	13	14	15	16	17	18	19	20
16.50	33.00	49.50	66.00	82.50	99.00	115.50	132.00	148.50	165.00	181.50	198.00	214.50	231.00	247.50	263.00	280.50	297.00	313.50	330.00		
1	66	116	133.66	50.16	66.66	83.16	99.66	116.16	132.66	149.16	165.66	182.16	198.66	215.16	231.66	248.16	264.66	281.16	297.66	314.16	330.66
2	132	17.82	34.32	50.82	67.32	83.82	100.32	116.82	133.32	149.82	166.32	182.82	199.32	215.82	232.32	248.82	265.32	281.82	298.32	314.82	331.32
3	198	18.48	34.98	51.48	67.98	84.48	100.98	117.48	133.98	150.48	166.98	183.48	199.98	216.48	232.98	249.48	265.98	282.48	298.98	315.48	331.98
4	264	19.14	35.64	52.14	68.64	85.14	101.64	118.14	134.64	151.14	167.64	184.14	200.64	217.14	233.64	250.14	266.64	283.14	299.64	316.14	332.64
5	330	19.80	36.30	52.80	69.30	85.50	102.30	118.80	135.30	151.80	168.30	184.80	201.30	217.80	234.30	250.80	267.30	283.80	300.30	316.80	333.30
6	396	20.46	36.96	53.46	69.96	86.46	103.96	120.46	136.96	153.46	169.96	185.46	201.96	218.46	234.96	251.46	267.96	284.46	300.96	317.46	333.96
7	462	21.12	37.62	54.12	70.62	87.12	103.62	120.12	136.62	153.12	169.62	186.12	202.62	219.12	235.62	252.12	268.62	285.12	301.62	318.12	334.62
8	528	21.78	38.28	54.78	71.78	87.78	104.78	121.78	137.28	153.78	170.28	186.78	203.28	219.78	236.28	252.78	269.28	285.78	302.28	318.78	335.28
9	594	22.44	38.94	55.44	71.94	88.44	104.94	121.44	137.94	154.44	170.94	187.44	203.94	220.44	236.94	253.44	269.94	286.44	302.94	319.44	335.94
10	660	23.10	39.60	56.10	72.60	89.10	105.60	122.10	138.60	155.10	171.60	188.10	204.60	221.10	237.60	254.10	270.60	287.10	303.60	320.10	336.60
11	726	23.76	40.26	56.76	73.26	89.76	106.26	122.76	139.26	155.76	172.26	188.76	205.26	221.76	238.26	254.76	271.26	287.76	304.26	320.76	337.26
12	792	24.42	40.92	57.42	73.92	90.42	106.92	123.42	139.92	156.42	172.92	189.42	206.92	222.42	238.92	255.42	271.92	288.42	304.92	321.42	337.92
13	858	25.08	41.58	58.08	74.58	91.08	107.58	124.08	140.58	157.08	173.58	190.08	206.58	223.08	239.58	256.08	272.58	289.08	305.58	322.08	338.58
14	924	25.74	42.24	58.74	75.24	91.24	108.24	124.24	141.24	157.74	174.24	190.24	207.24	223.24	240.24	256.74	273.24	289.74	306.24	322.74	339.74
15	990	26.40	42.90	59.40	75.90	92.40	109.90	125.40	141.90	158.40	174.90	191.40	207.90	224.40	240.90	257.40	273.90	290.40	306.90	323.40	339.90
16	1056	27.06	43.56	60.06	76.56	93.06	109.56	126.06	142.56	159.06	175.56	192.06	208.56	225.06	241.56	258.06	274.56	291.06	307.56	324.06	340.56
17	1122	27.72	44.22	60.72	77.22	93.72	110.22	126.72	143.22	159.72	176.22	192.72	209.22	225.72	242.22	258.72	275.22	291.72	308.22	324.72	341.22
18	1188	28.38	44.88	61.38	77.88	94.38	110.88	127.38	143.88	160.38	176.88	193.38	209.88	226.38	242.88	259.38	275.88	292.38	308.88	325.38	341.88
19	1254	29.04	45.54	62.04	78.54	95.04	111.54	128.04	144.54	161.04	177.54	194.04	210.54	227.04	243.54	260.04	276.54	293.04	309.54	326.04	342.54
20	1320	29.70	46.20	62.70	79.20	95.70	112.20	128.70	146.20	163.70	180.70	197.20	213.70	227.70	243.70	260.70	277.70	293.70	310.20	326.70	343.20
21	1386	30.36	46.86	63.36	79.86	96.36	112.86	129.36	145.86	162.36	179.86	195.36	211.86	228.36	244.86	261.36	277.86	294.36	310.86	327.36	343.86
22	1452	31.02	47.52	64.02	80.52	97.02	113.52	130.02	146.52	163.02	179.52	196.02	212.52	229.02	245.52	262.02	278.52	295.02	311.52	328.02	344.52
23	1518	31.68	48.18	64.68	81.18	97.68	114.18	130.68	147.18	163.68	180.18	196.68	213.18	229.68	246.18	262.68	279.18	295.68	312.18	328.68	345.18
24	1584	32.34	48.84	65.34	81.84	98.34	114.84	131.34	147.84	164.34	180.84	197.34	213.84	230.34	246.84	263.34	279.84	296.34	312.84	329.34	345.84
25	1650	33.00	49.50	66.00	82.50	98.00	115.50	132.00	148.50	165.00	181.50	198.00	214.50	231.00	247.50	264.00	280.50	297.00	313.50	330.00	346.50

LAND COURT

TABLE OF RODS AND LINKS EXPRESSED IN FEET

LINKS	R	O	D	S																	
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40		
346.50	363.00	379.50	396.00	412.50	428.00	445.50	462.00	478.50	495.00	511.50	528.00	544.50	561.00	577.50	594.00	610.50	627.00	643.50	660.00		
1	347.16	363.66	380.16	396.66	413.16	429.66	446.16	462.66	479.16	495.66	512.16	528.66	545.16	561.66	578.16	594.66	611.16	627.66	644.16	660.66	
2	347.82	364.32	380.82	397.32	413.82	430.32	446.82	463.32	479.82	496.32	512.82	529.32	545.82	562.32	578.82	595.32	611.82	628.32	644.82	661.32	
3	348.48	364.98	381.48	397.98	414.48	430.98	447.48	463.98	480.48	496.98	513.48	529.98	546.48	562.98	579.48	595.98	612.48	628.98	645.48	661.98	
4	349.14	365.64	382.14	398.64	415.14	431.64	448.14	464.64	481.14	497.64	514.14	530.64	547.14	563.64	580.14	596.64	613.14	629.64	646.14	662.64	
5	349.80	366.30	382.80	399.30	415.80	432.30	448.80	465.30	481.80	498.30	514.80	531.30	547.80	564.30	580.80	597.30	613.80	630.30	646.80	663.30	
6	350.46	366.96	383.46	399.96	416.46	432.96	449.46	465.96	482.46	498.96	515.46	531.96	548.46	564.96	581.46	597.96	614.46	630.96	647.46	663.96	
7	351.12	367.72	384.12	394.72	400.62	417.12	433.62	450.12	466.62	483.12	499.62	516.12	532.62	549.12	565.62	582.12	598.62	615.12	631.62	648.12	664.62
8	351.78	368.28	384.78	394.78	401.28	417.78	434.28	450.78	467.28	483.78	500.28	516.78	533.28	549.78	566.28	582.78	599.28	615.78	632.28	648.78	665.28
9	352.44	368.94	385.44	396.94	413.44	430.94	445.44	462.94	479.44	495.94	511.44	533.94	550.44	566.94	583.44	599.94	616.44	632.94	649.44	665.94	
10	353.10	369.60	386.10	396.60	413.10	433.60	450.10	468.60	485.10	501.60	518.10	534.60	551.10	567.60	584.10	600.60	617.10	633.60	650.10	666.60	
11	353.76	370.26	386.76	396.76	403.26	419.76	436.26	452.76	469.26	485.76	502.26	518.76	535.26	551.76	568.26	584.76	601.26	617.76	634.26	650.76	667.26
12	354.42	370.92	387.42	393.92	402.42	418.92	435.92	453.42	469.92	486.42	502.92	519.42	535.92	552.42	568.92	585.42	601.92	618.42	635.92	651.42	667.92
13	355.08	371.58	388.08	394.58	402.08	417.58	433.58	449.58	467.58	483.58	500.08	516.58	533.08	550.58	568.08	585.58	602.58	619.08	635.58	652.08	668.58
14	355.74	372.24	388.74	395.24	412.24	428.24	445.24	471.24	487.74	504.24	521.24	537.24	553.74	570.24	586.74	603.24	619.74	636.24	652.74	669.24	
15	356.40	372.90	389.40	405.90	422.40	438.90	455.40	471.90	488.40	504.90	521.40	537.90	554.40	570.90	587.40	603.90	620.40	636.90	653.40	669.90	
16	357.06	373.56	390.06	406.56	423.06	439.56	456.06	472.56	489.06	505.56	522.06	538.56	555.06	571.56	588.06	604.56	621.06	637.56	654.06	671.56	
17	357.72	374.22	390.72	407.22	423.72	440.22	456.72	473.22	489.72	506.22	522.72	539.22	555.72	572.22	588.72	605.22	621.72	638.22	654.72	671.22	
18	358.38	374.88	391.38	407.88	424.38	440.88	457.38	473.88	490.38	506.88	523.38	539.88	556.38	572.88	589.38	605.88	622.38	638.88	655.38	671.88	
19	359.04	375.54	392.04	408.54	425.04	441.54	458.04	474.54	491.04	507.54	524.04	540.54	557.04	573.54	590.04	606.54	623.04	639.54	656.04	672.54	
20	359.70	376.20	392.70	409.20	425.70	442.20	458.70	475.20	491.70	508.20	524.70	541.20	557.70	574.20	590.70	607.20	623.70	640.20	656.70	673.20	
21	360.36	376.86	393.36	409.86	426.36	442.86	459.36	475.86	492.36	508.86	525.36	541.86	558.36	574.86	591.36	607.86	624.36	640.86	657.36	673.86	
22	361.02	377.52	394.02	410.52	427.02	443.52	460.02	476.52	493.02	509.52	526.02	542.52	559.02	575.52	592.02	608.52	625.02	641.52	658.02	674.52	
23	361.68	378.18	394.68	411.18	427.68	444.18	460.68	477.18	493.68	510.18	526.68	543.18	560.68	576.18	592.68	609.18	625.68	642.18	658.68	675.18	
24	362.34	378.84	395.34	411.84	428.34	444.84	461.34	477.84	494.34	510.84	527.34	543.84	560.34	576.84	593.34	609.84	626.34	642.84	659.34	675.84	
25	363.00	379.50	396.00	412.50	429.00	445.50	462.00	478.50	495.00	511.50	528.00	544.50	561.00	577.50	594.00	610.50	627.00	643.50	660.00	676.50	

LAND COURT
TABLE OF RODS AND LINKS EXPRESSED IN FEET

LINKS	R O D S																			
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
1 676.50 693.00	709.50	726.00	742.50	759.00	775.50	792.00	808.50	825.00	844.50	858.00	874.50	891.00	907.50	924.00	940.50	957.00	973.50	990.00	990.00	
1 677.16 693.66	710.16	726.66	743.16	759.66	776.16	792.66	809.16	825.66	842.16	858.66	875.16	891.66	908.16	924.66	941.16	957.66	974.16	990.66	990.66	
2 677.82 694.32	710.82	727.32	743.82	760.32	776.82	793.32	809.82	826.32	842.82	859.32	875.82	892.32	908.82	923.32	941.82	958.32	974.82	991.32	991.32	
3 678.48 694.98	711.48	727.98	744.48	760.98	777.48	793.98	810.48	826.98	843.48	859.98	876.48	892.98	909.48	925.98	942.48	958.98	975.48	991.98	991.98	
4 679.14 695.64	712.14	728.64	745.14	761.64	778.14	794.64	811.14	827.64	844.14	860.64	877.14	893.64	910.14	926.64	943.14	959.64	976.14	992.64	992.64	
5 679.80 696.30	712.80	729.30	745.80	762.30	778.80	795.30	811.80	828.30	844.80	861.30	877.80	894.30	911.80	927.30	943.80	960.30	976.80	993.30	993.30	
6 680.46 696.96	713.46	729.96	746.46	762.96	779.46	795.96	812.46	828.96	845.46	861.96	878.46	894.96	911.46	927.96	944.46	960.96	977.46	993.96	993.96	
7 681.12 697.62	714.12	730.62	747.12	763.62	780.12	796.62	813.12	829.62	846.12	862.62	879.12	895.62	912.12	928.62	945.12	961.62	978.12	994.62	994.62	
8 681.78 698.28	714.78	731.28	747.78	764.28	780.78	797.28	813.78	830.28	846.78	863.28	879.78	896.28	912.78	929.28	945.78	962.28	978.78	995.28	995.28	
9 682.44 698.94	715.44	731.94	748.44	764.94	781.44	797.94	814.44	830.94	847.44	863.94	880.44	896.94	913.44	929.94	946.44	962.94	979.44	993.94	993.94	
10 683.10 699.60	716.10	732.60	749.10	765.60	782.10	798.60	815.10	831.60	848.10	864.60	881.10	897.60	914.10	930.60	947.10	963.60	980.10	996.60	996.60	
11 683.37 700.26	716.76	733.26	749.76	766.26	782.76	799.26	815.76	832.26	848.76	865.26	881.76	898.26	914.76	931.26	947.76	964.26	980.76	997.26	997.26	
12 684.42 700.92	717.42	733.92	750.42	766.92	783.42	799.92	816.42	832.92	849.42	865.92	882.42	898.92	915.42	931.92	948.42	964.92	981.42	997.92	997.92	
13 685.08 701.58	718.08	734.58	751.08	767.58	784.08	800.58	817.08	833.58	850.08	866.58	883.08	899.58	916.08	932.58	949.08	965.58	982.08	998.58	998.58	
14 685.74 702.24	718.74	735.24	751.74	768.24	784.74	801.24	817.74	834.24	850.74	867.24	883.74	900.24	916.74	933.24	949.74	966.24	982.74	999.24	999.24	
15 686.40 702.90	719.40	735.90	752.40	768.90	785.40	801.90	818.40	834.90	851.40	867.90	884.40	900.90	917.40	933.90	950.40	966.90	983.40	999.90	999.90	
16 687.06 703.56	720.06	736.56	753.06	769.56	786.06	802.56	819.06	833.56	852.06	868.56	885.06	901.56	918.06	934.56	951.06	967.56	984.06	999.56	999.56	
17 687.72 704.22	720.72	737.22	753.72	770.22	786.72	803.22	819.72	836.22	852.72	869.22	885.72	902.22	918.72	933.22	951.72	968.22	984.72	999.72	999.72	
18 688.38 704.88	721.38	737.88	754.38	770.88	787.38	803.88	820.38	836.88	853.38	869.88	886.38	902.88	919.38	933.88	950.38	968.88	985.38	999.88	999.88	
19 689.04 705.54	722.04	738.54	755.04	771.54	788.04	804.54	821.04	837.54	854.04	870.54	887.04	903.54	920.04	936.54	953.04	969.54	986.04	999.54	999.54	
20 689.70 706.20	722.70	739.20	755.70	772.20	788.70	805.20	821.70	838.20	854.70	871.20	887.70	904.20	921.70	937.20	953.70	970.20	986.70	999.20	999.20	
21 690.36 706.86	723.36	739.86	756.36	772.86	789.36	805.86	822.36	838.86	855.36	871.86	888.36	904.86	921.36	937.86	954.36	970.86	987.36	999.86	999.86	
22 691.02 707.52	724.02	740.52	757.02	773.52	790.02	806.52	823.02	839.52	856.02	872.52	889.02	905.52	922.02	938.52	955.02	971.52	988.02	999.52	999.52	
23 691.68 708.18	724.68	741.18	757.68	774.18	790.68	807.18	823.68	840.18	856.68	873.18	889.68	906.18	922.68	939.18	955.68	972.18	988.68	999.18	999.18	
24 692.34 708.84	725.34	741.84	758.34	774.84	791.34	807.84	824.34	840.84	857.34	873.84	890.34	906.84	923.34	939.84	956.34	972.84	988.34	999.84	999.84	
25 693.00 709.50	726.00	742.50	759.00	775.50	792.00	808.50	825.00	841.50	858.00	874.50	891.00	907.50	924.00	940.50	957.00	973.50	990.00	990.00	990.00	

MAGNETIC DECLINATION.

Surveys for the land court must be made with a transit and tape, as per instructions, but as it is at times necessary to know the variation for certain years, the tables below are given.

Whenever the surveyor is called upon to redetermine the boundary line of a tract of land run out at some previous period with a compass, and can find in the vicinity a well-defined line known to have been established with the same compass and at about the same time as the survey of the tract under consideration, he cannot do better than determine the amount of the change in the compass bearing of this well-defined line and use it to obtain the present bearings of the boundary lines to be re-established. In this way he will also take into account the error of the compass used. Only in the absence of such definite information is the use of these tables recommended.

While the declination is given at the place observed, it serves to represent equally well the change in direction of the compass needle in other parts of the general region. The values are for January 1 of the year given in tables.

Months and Days expressed as a Fraction of a Year.¹

Jan. 0,	. . . . .	0.00	July 2,	. . . . .	0.50
Jan. 18,	. . . . .	0.05	July 20,	. . . . .	0.55
Feb. 6,	. . . . .	0.10	Aug. 7,	. . . . .	0.60
Feb. 24,	. . . . .	0.15	Aug. 25,	. . . . .	0.65
Mar. 14,	. . . . .	0.20	Sept. 13,	. . . . .	0.70
Apr. 1,	. . . . .	0.25	Oct. 1,	. . . . .	0.75
Apr. 20,	. . . . .	0.30	Oct. 19,	. . . . .	0.80
May 8,	. . . . .	0.35	Nov. 7,	. . . . .	0.85
May 26,	. . . . .	0.40	Nov. 25,	. . . . .	0.90
June 13,	. . . . .	0.45	Dec. 13,	. . . . .	0.95

¹ From Coast and Geodetic Survey, Magnetic Tables for 1905, pp. 100 and 103.

*Secular Change of the Magnetic Declination.¹**Eastern Massachusetts.—Boston (Latitude 42° 3' N.; Longitude 71° 0' W.).*

1750,	.	.	7° 46' W.	1840,	.	.	9° 04' W.
1760,	.	.	7° 19'	1850,	.	.	9° 48'
1770,	.	.	7° 00'	1860,	.	.	10° 28'
1780,	.	.	6° 50'	1870,	.	.	11° 01'
1790,	.	.	6° 50'	1880,	.	.	11° 32'
1800,	.	.	7° 01'	1890,	.	.	12° 02'
1810,	.	.	7° 20'	1900,	.	.	12° 34'
1820,	.	.	7° 47'	1905,	.	.	12° 51'
1830,	.	.	8° 22'				

Annual change in 1905, 3.4' incr.

Western Massachusetts.—Pittsfield (Latitude 42° 4' N.; Longitude 73° 3' W.).

1750,	.	.	6° 21' W.	1840,	.	.	7° 21' W.
1760,	.	.	5° 52'	1850,	.	.	8° 05'
1770,	.	.	5° 31'	1860,	.	.	8° 43'
1780,	.	.	5° 19'	1870,	.	.	9° 17'
1790,	.	.	5° 17'	1880,	.	.	9° 58'
1800,	.	.	5° 25'	1890,	.	.	10° 25'
1810,	.	.	5° 42'	1900,	.	.	10° 59'
1820,	.	.	6° 08'	1905,	.	.	11° 15'
1830,	.	.	6° 41'				

Annual change in 1905, 3.2' incr.

Example: What was the declination at Swampscott on March 18, 1873?

The value for 1870 and 1880 are 11° 01' W. and 11° 32' W., showing an average annual increase of 3.1'; hence the value for March 18, 1873, would be $11^{\circ} 01' + (3.1 \times 3.21) = 11^{\circ} 01' + 10' = 11^{\circ} 11' W.$

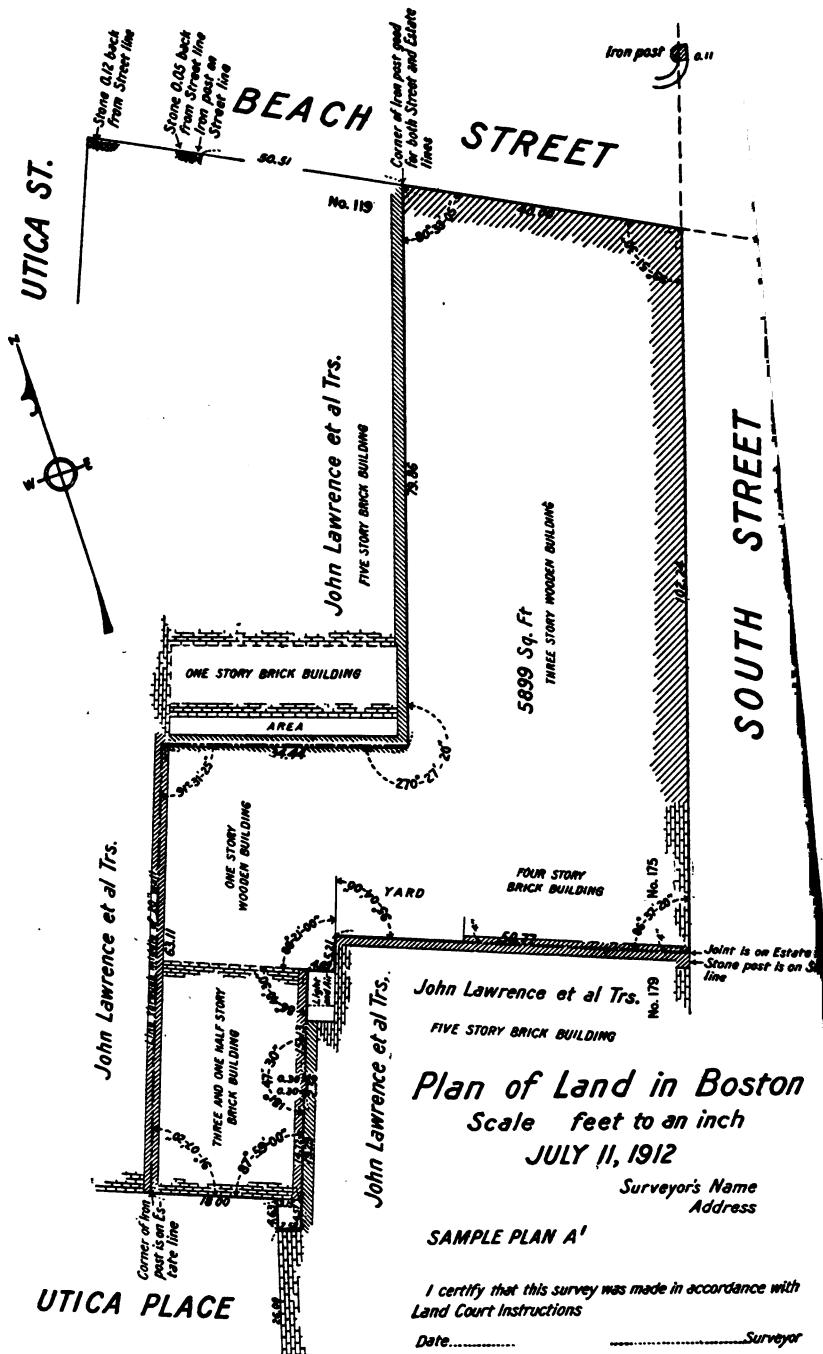
Chapter 286, Acts of 1870, required each land surveyor in the state, at least once in every year, to adjust and verify his compass by the meridian line established in the county wherein his surveys were to be made. This law was modified under chapter 13, Acts of 1875, so that surveyors who did not use the compass in turning angles were relieved from the penalty attached to the violation of the original act.

¹ From Coast and Geodetic Survey, Magnetic Tables for 1905, pp. 100 and 103.

*Average of Readings West of North taken by Survey Department, City
of Boston.¹*

1871,	.	.	.	10° 53' 46"	1892,	.	.	.	-
1872,	.	.	.	11° 09' 47"	1893,	.	.	.	12° 32' 20"
1873,	.	.	.	11° 07' 53"	1894,	.	.	.	-
1874,	.	.	.	11° 11' 40"	1895,	.	.	.	-
1875,	.	.	.	10° 58' 33"	1896,	.	.	.	-
1876,	.	.	.	11° 13' 00"	1897,	.	.	.	12° 04' 37"
1877,	.	.	.	11° 12' 35"	1898,	.	.	.	12° 34' 34"
1878,	.	.	.	11° 28' 56"	1899,	.	.	.	-
1879,	.	.	.	11° 35' 15"	1900,	.	.	.	12° 33' 45"
1880,	.	.	.	11° 34' 53"	1901,	.	.	.	-
1881,	.	.	.	11° 28' 23"	1902,	.	.	.	12° 44' 44"
1882,	.	.	.	11° 36' 18"	1903,	.	.	.	12° 43' 42"
1883,	.	.	.	11° 42' 04"	1904,	.	.	.	12° 48' 45"
1884,	.	.	.	11° 46' 13"	1905,	.	.	.	12° 56' 42"
1885,	.	.	.	11° 43' 12"	1906,	.	.	.	13° 19' 20"
1886,	.	.	.	11° 39' 58"	1907,	.	.	.	13° 16' 35"
1887,	.	.	.	11° 51' 54"	1908,	.	.	.	13° 27' 05"
1888,	.	.	.	11° 40' 57"	1909,	.	.	.	13° 30' 46"
1889,	.	.	.	-	1910,	.	.	.	13° 35' 30"
1890,	.	.	.	11° 39' 56"	1911,	.	.	.	13° 41' 45"
1891,	.	.	.	11° 49' 30"					

¹ See City Document, No. 35, for year 1912.



*I certify that this survey was made in accordance with
Land Court Instructions*

Date..... Surveyor.....

UTICA PLACE

Calculation Sheet accompanying Sample Plan A
LAND COURT

Land in Surveyed by Plan No.

STA.	INTERIOR ANGLE	DEF. ANGLE	AZIMUTH	DISTANCE	+ SINE	- SINE	+ COSINE	- COSINE
1	99° 51' 30"	+80° 08' 30"	00° 00' -00"	102.24			102.24	
2	86 37 20	+93 22 40	93 - 22 -40	50.77	50.77			2.99
3	275 04 00	-95 04 00	358 - 18 -40	5.21		0.15	5.21	
4	88 21 00	+91 39 00	89 - 57 -40	4.09	4.09			
5	266 40 30	-86 40 30	3 - 17 -10	15.13	0.87		15.10	
6	181 47 30	- 47 30	1 - 29 -40	17.28	0.45		17.28	
7	87 59 00	+92 01 00	93 - 30 -40	21.15	21.11		1.30	
8	91 07 20	-88 52 40	182 - 23 -20	63.11		2.63		63.05
9	91 31 25	+88 28 35	270 - 51 -55	34.44		34.44	0.52	
10	270 27 20	-90 27 20	180 - 24 -35	79.86		0.57		79.86
11	80 33 05	+89 26 55	279 - 51 -30	40.00		39.41	6.85	
	<u>1620 00 00</u>			<u>433.28</u>	<u>77.20</u>	<u>77.20</u>	<u>147.20</u>	<u>147.20</u>

Calculation Sheet accompanying Sample Plan A²
LAND COURT

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STA.	INTERIOR ANGLE	DEF. ANGLE	BEARING	DISTANCE	LATITUDE		DEPARTURE	Plan No.
					N.	S.		
1	110° - 56' - 00"	69° - 04' - 00"	N. 50° - 30' - 00" W.	296.23	188.42		228.59	
2	87 - 03 - 30	92 - 56 - 30	N. 42 - 26 - 20 E.	100.87	74.44		68.07	
3	91 - 19 - 20	88 - 40 - 40	S. 48 - 53 - 00 E.	80.00		52.61	60.27	
4	270 - 23 - 30	90 - 23 - 30	N. 40 - 43 - 30 E.	102.33	77.55		65.76	
5	90 - 53 - 00	89 - 07 - 00	S. 50 - 09 - 30 E.	186.96		119.78	143.55	
6	271 - 15 - 10	91 - 15 - 10	N. 38 - 35 - 20 E.	13.04	10.19		8.13	
7	68 - 09 - 30	111 - 50 - 30	S. 28 - 34 - 10 E.	96.67		84.08	47.71	
8	90 - 00 - 00	90 - 00 - 00	S. 60 - 25 - 50 W.	190.74		94.13	165.90	
	<u>1080 - 00 - 00</u>			<u>1066.84</u>	<u>350.60</u>	<u>350.60</u>	<u>394.49</u>	<u>394.49</u>

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12/29/16

